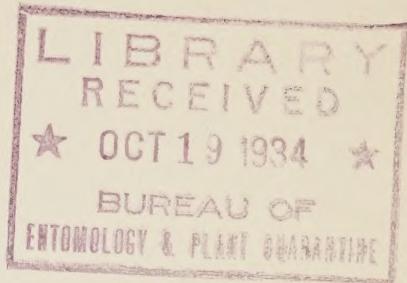


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UNITED STATES
DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

SUMMARY OF COOPERATIVE GRASSHOPPER CONTROL CAMPAIGN
OF 1934

Prepared for Grasshopper Conference, August 31, 1934, at Denver, Colorado.

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SUMMARY OF COOPERATIVE GRASSHOPPER CONTROL CAMPAIGN OF 1934

Prepared for the Grasshopper Conference
Held August 31, 1934, at Denver, Colorado,
by
P. N. Annand, In Charge, Division of Cereal
& Forage Insects, Bureau of Entomology &
Plant Quarantine.

This campaign was conducted cooperatively by the Bureau of Entomology and Plant Quarantine, of the United States Department of Agriculture, and the States of Arizona, California, Colorado, Idaho, Iowa, Kansas, Michigan, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Wisconsin, and Wyoming.

I. An appropriation of \$2,354,893 was made by Congress in recognition of the emergency nature of the severe outbreak which was anticipated in the fall of 1933 affecting primarily the Northern Great Plains States and the States of Montana, Idaho, and Wyoming. It was anticipated that this appropriation would be required particularly to combat grasshoppers in the extensive area which had been severely affected by grasshopper outbreaks in the year previous and which was unable because of its financial circumstances adequately to combat the grasshopper plague through local or state resources. This appropriation was made available March 29, 1934. The amount provided was based very largely on estimates made possible through a fall survey conducted cooperatively by the Bureau of Entomology and a number of states during the fall of 1933.

II. Fall Survey of 1933 and Basis for Original Allotments.

(A) Surveyed Area

(1) States included in fall survey: Montana, Idaho, Wyoming, North Dakota, South Dakota, Minnesota. In addition to these states, estimates were available indicating that there would be a severe infestation in Nebraska and Wisconsin so that these two states were included in the estimate figure.

(2) Methods Used

The methods used in this survey were worked out at the Bozeman, Mont., laboratory of the Bureau of Entomology and Plant Quarantine, under the direction of Dr. J. R. Parker, who was responsible for coordinating the egg survey activities in the various states and for placing them on a comparable basis. These methods will be discussed at this conference.

(3) Results

Tabulation showing the results of the 1933 fall survey, in terms of bait and funds required, including estimates for the States of Wisconsin and Nebraska, is given below:

TABLE SHOWING RESULTS OF 1933 FALL SURVEY

<u>State</u>	<u>Number of Counties Infested</u>	<u>Number of Acres Weeding Poisoning</u>	<u>Total Tons of Bait Needed</u>	<u>Total Cost of Bait (Not Including Transportation)</u>
North Dakota	53	5,439,680	27,198	\$679,960.00
Montana	49	3,613,058	18,065	451,625.00
South Dakota	68	2,567,396	12,825	320,623.00
Wyoming	12	841,600	4,208	105,200.00
Minnesota	21	279,834	1,667	41,670.00
Wisconsin*	15	320,000	1,600	40,000.00
Nebraska*	10	200,000	1,000	25,000.00
Idaho	10	120,000	600	15,000.00
All Others	—	—	8,000	<u>200,000.00</u>
Total	238	13,381,568	75,163	\$1,879,078.00

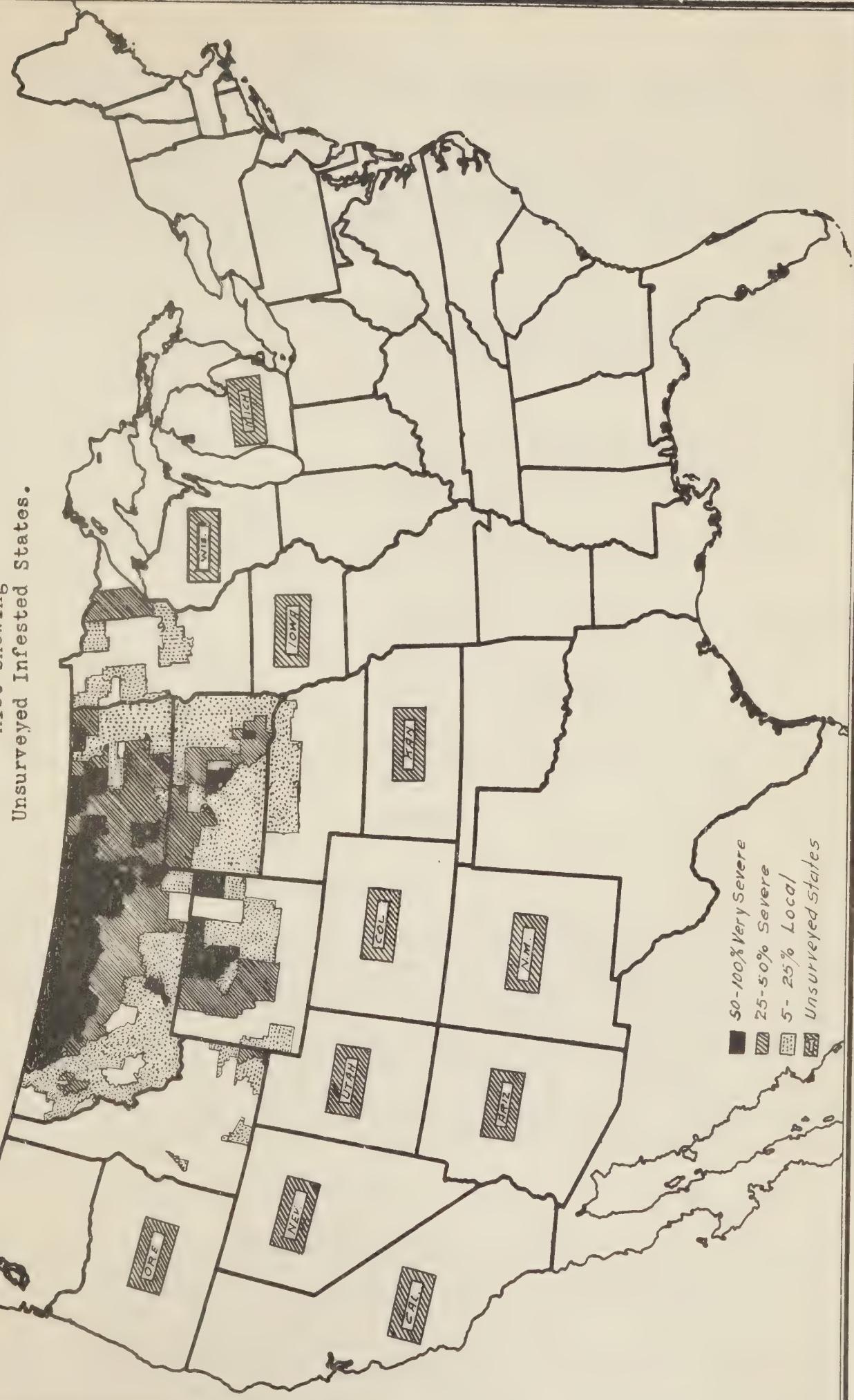
*Estimate not based on actual survey.

A map of the infested area is given on Page 3, which indicates the degree of severity anticipated in the various areas and also the states not surveyed to which Federal aid was extended during the season.

(B) Unsurveyed Area

It was recognized that undoubtedly there were infestations in states other than those in which the detailed survey had been made. There was no accurate means of estimation of this infestation, however, and a total of 8,000 tons of bait was set up to provide for this requirement. It was also anticipated that there might be a considerable discrepancy between the extent of the infestations estimated in the States of Wisconsin and Nebraska and those actually occurring. It was impossible to set up any definite amount to cover the unsurveyed areas, and therefore allotment of materials to unsurveyed states through the season had to be done very largely on the basis of estimates received from state men and from our own workers where they were in a position to obtain these estimates. Allotments had to be pared to fit the amount of bait available.

FALL GRASSHOPPER SURVEY 1933 AND EXPECTED INFESTATION OF CROPS IN 1934
Also showing
Unsurveyed Infested States.



OUTLINE MAP OF THE UNITED STATES

Accuracy of the Fall Survey As Indicated by Later Infestation: Data are not available at this time to determine definitely the degree of agreement between the infestation that developed in 1934 and the survey of the previous fall. In general it did, however, indicate the areas in which the heaviest infestation could be expected and, although there was some discrepancy, it gave a fairly accurate basis for estimation of requirements. Preliminary reports from the various states indicating the accuracy of the fall survey estimate are reviewed below:

<u>State</u>	<u>Extent of Infestation as Compared to Fall Survey Estimate</u>
North Dakota	Accurate
Montana	Remarkably accurate except in southeastern section where survey inadequate
South Dakota	Accurate except in western and southwestern part
Wyoming	Survey slightly under actual infestation
Minnesota	Estimates two-thirds under actual (bait requirements)
Nebraska	No fall survey made. Accurate as to spring survey.
Idaho	Varied

III. Federal and State Organization

The appropriation provided that the grasshopper control work be conducted cooperatively by the Department of Agriculture and such authorities of the states concerned as in the judgment of the Secretary of Agriculture might be necessary. The Secretary of Agriculture under this provision issued a statement of method of procedure which called for the formation in each state of a Grasshopper Control Committee which was to be responsible for the allotment of materials within the state and in the conduct of state phases of the campaign. The Bureau of Entomology was designated by the Secretary to conduct the Federal phases of the campaign.

(A) Federal Organization

The campaign was directed by the Bureau of Entomology and Plant Quarantine through the Division of Cereal and Forage Insects, P. N. Annand, in charge. The campaign in the field was directed by J. R. Parker, with B. M. Gaddis, Assistant in charge of the Minneapolis office and responsible for purchasing, mixing, inspection, and transportation of bait. Eight chemists were employed as Mill Inspectors, under the direction of S. S. Easter, attached to the Minneapolis office, to check on the arsenic content and quality of the bait previous to shipment. Assistant supervisors were employed under Federal funds for the various states

where it was impossible for the states to provide adequate personnel to handle the campaign. In some cases where there were no county agents, it was necessary to employ a number of county or district men to do the work which would otherwise have been done by the regular county agents. The number of Federal employees who worked under the direction of State Leaders are indicated below:

<u>State</u>	<u>Assistant State Leaders</u>	<u>County & District Leaders</u>
Colorado	1	0
Idaho	1	0
Minnesota	1	1
Montana	3	10
Nebraska	1	0
Nevada	1	0
New Mexico	0	2
North Dakota	3	4
South Dakota	3	0
Wisconsin	0	3
Wyoming	3	0
Total	17	20

Special assistance to Utah, Oregon, Arizona, and California was given by G. I. Reeves, L. P. Rockwood, V. L. Wildermuth, and C. C. Wilson, all of the permanent staff of the Bureau of Entomology and Plant Quarantine.

(B) State Organization

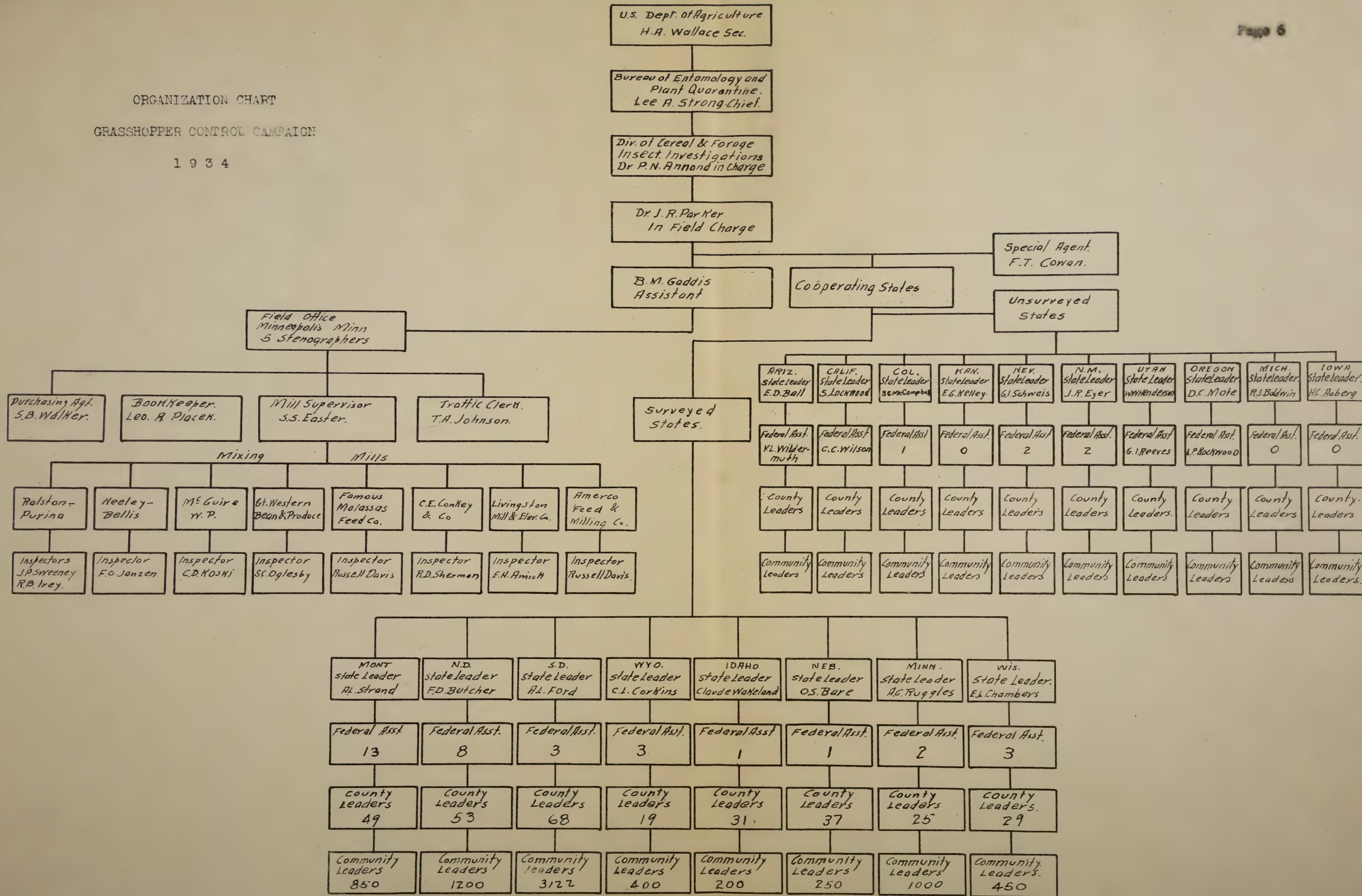
State organizations will not be reviewed here in detail. The essentials of organization were very similar in the various states and were under the direction of the State Grasshopper Control Committees which appointed State Leaders. These State Leaders were entomologists of the Experiment Stations, Extension Entomologists, or entomologists of the State Departments of Agriculture--depending on the organization in the states involved. The campaign in the field was largely built around the county agent organization. The efficient organization of the states, from the Grasshopper Control Committee down to the individual farmer, was one of the most important factors in conducting this campaign effectively.

Chart showing the Federal and State organization is given on Page 6 .

ORGANIZATION CHART

GRASSHOPPER CONTROL CAMPAIGN

1934





IV. Purchase of Materials and Bait Production

(A) Method of Making Purchases

At the beginning of the campaign bids for the various ingredients and for mixing were obtained through the Washington office. It was recognized, however, that owing to the emergency nature of the campaign and the limited availability of materials, particularly bran and arsenic, it would be necessary to make open-market purchases in the field or to obtain bids in the field for direct purchase of materials. A large number of purchases were made in this way. It is of interest to note that field purchases of bran, which were made principally on open market and informal bids, averaged \$2.71 per ton less than the initial purchases made on competitive bids, although these field purchases covered a period of time when the bran market was materially and consistently higher, with the exception of one brief period, than was the case at the time of initial purchases. This may possibly have been due to the stimulation of prices resulting from the demand for abnormally large quantities. In some cases where all bids were declined due to unjustifiable prices, the same material was purchased within two or three days for \$2 to \$3 per ton lower than the bid, although the general market trend was slightly upward.

A table indicating the amounts and cost of raw materials used in the Grasshopper Control Campaign of 1934 is given below:

<u>Product</u>	<u>Total Tons</u>	<u>Total Cost</u>	<u>Net Average Cost</u>
Wheat Bran	42,933.1	\$809,582.89	\$18.86
Molasses	10,608.3	99,378.67	9.36
Arsenic	3,962.9	137,297.08	34.65
Sawdust	<u>22,022.4</u>	<u>37,562.82</u>	1.70
Total	79,526.7	\$1,083,821.46	
Mixing Contracts	70,481.38	\$352,081.15	\$4.99
Sodium Arsenite	175,365 gal.	\$46,550.38	\$.26 1/2
Total Cost All Materials and Mixing			--- \$1,482,452.99

Wheat Bran

In point of volume and cost, wheat bran was by far the most important item of purchase and 1,700 carloads were required for delivery in a relatively short time. In spite of this large quantity needed in addition to the regular commercial requirements, the extended spring drought which decidedly increased the feed demand, and the abnormally light flour demand during the spring months, the purchase and delivery of the required tonnage of bran was consummated without serious difficulty. Much apprehension was felt at times, however, in regard to bran purchases and they had to be made with careful regard for the market and the geographical availability of the materials. The bran prices at decentralized flour mills throughout the Northwest are generally based on existing prices at larger milling centers, less the cost of delivery to these marketing centers. By virtue of the half-rate delivery privilege

extended by the railroads, it was possible to effect material savings by purchasing from country mills and by so doing partially to supply the needs without drawing so heavily direct from market center supplies which action would have more readily affected prices. This frequently made it advantageous from a price standpoint, where time permitted, to purchase the bran at points distant from the areas in which it was to be used rather than from mills which were closer to the final delivery points. As a matter of policy, the status of our bran consumption, stock, purchases or needs was not discussed with the public.

Molasses

All molasses was purchased from one concern except for 2,000 gallons which were purchased for use in the State of Arizona.

Arsenic

Adequate supplies of arsenic were available for mixing the bait produced under the Federal appropriation. Toward the end of the campaign, however, arsenic was becoming very scarce due partially to strikes which tied up one of the larger arsenic producers.

Sawdust

The supply of sawdust was more than ample but accessibility, moisture content, screening requirements and volume demands were aggravating and limiting factors in the procurement of this material. Spring thaws resulted in impassable roads leading to supplies remote from railroads, and in excess moisture in shallow piles. The volume of bait production required a constant and uniform loading of approximately 400 tons of sawdust daily. Intelligent routing and effective delivery of this material demanded dependable production. Field purchases of sawdust show a higher price per ton than those of initial purchases due to necessity of cancelling one original contract and to field purchases including delivery to mixing mills at Billings and Livingston, Montana.

(B) Specifications for Materials

The specifications used for the purchase of materials may possibly be of some interest in connection with future campaigns. These specifications follow:

Bran - Wheat bran known to the trade as "Standard" or "Commercial" bran. Not more than 8% mill run screenings permitted. To be delivered in hundred-pound sacks which will become the property of the Government.

Molasses - Molasses shall be what is known as Black-Strap Cane Molasses and shall have a concentration of not less than 42° Baume at a temperature of 70° Fahrenheit.

Arsenic - Finely divided "Crude" "Baghouse" or "upperkitchen" arsenic or a mixture of any of these grades. It must contain not less than 90% AS₂O₃.

Much difficulty was experienced in the use of 2,100 tons of crude arsenic procured on the initial purchase due to the excessive moisture content resulting in the production of crystalized lumps, making it difficult to feed and mix and resulting in broken machinery and temporary shutdown of mixing mills. The ratio of arsenic sufficient to assure ample killing power in all bait produced when using this arsenic had to be increased because of the impossibility of securing uniform distribution; this, of course, resulted in excess arsenic in much of the bait and lumps of free arsenic in all bait. The visible lumps occurring in bait manufactured with this material constituted excess arsenic without which the bait had ample killing power. The specifications for the purchase of this material were inadequate in that they overlooked the very important factor of moisture content. The specification, however, that the arsenic be finely divided made it possible to require the screening of this arsenic which eliminated to a great extent the problem of lumps in future shipments.

Sawdust - Old, well preserved pine or hardwood sawdust that has lain in pile at least two years. Must be screened through 1/2" mesh screen and must not contain excessive moisture.

Mixing - Mixing bids included following requirements:

"Furnishing of necessary equipment and labor for mixing grasshopper bait according to the following formula -

Bran	80%	by weight
Molasses	15%	" "
White Arsenic. . .	5%	" "

"The Government reserves and may exercise the right to substitute sawdust for bran in an amount not in excess of 50% by bulk. All ingredients will be furnished by the Government, delivered to bidder f.o.b. common carrier at city in which bidder's mill is located, bidder to unload and furnish transportation from common carrier to mill and storage facilities, if necessary, for period not to exceed 15 days."

A review of the ingredients to be used and a statement of the way in which they were to be delivered to the mill was then given. It was required that the product be delivered in large sacks, approximately 80 lbs. each, without packing or tamping, and that the bidder indicate the number of tons of grasshopper bait he agreed to mix and ship per calendar day and the number of calendar days required to make the initial shipment.

This Bureau will be glad to furnish more detailed information on the specifications for mixing and for the various ingredients should any of the states in the future be interested in the production of bait for grasshopper control campaigns.

(C) Mill Inspection

The product produced by the various mixing contractors was very carefully inspected and an analysis made of the arsenic content. The establishment of close control on the milling operation unquestionably was the main factor in producing bait with uniformly high-killing power and also resulted in the saving of much arsenic in preventing the production of bait having a content of arsenic higher than specified. Percentage arsenic analyses by days at all of the mixing mills is given in the following table:

PERCENTAGE ARSENIC ANALYSES BY DAYS AT ALL MIXING MILLS

MILL	No. of Days	No. of Samples	Average No.	Total Analyses	Average Daily Analysis (Per Cent)
			Daily Samples		
Ralston Purina Co.	59	2930	50	13256.3	4.52
Necly & Bellis	66	2158	33	9564.6	4.43
W. P. McGuire	48	2040	43	9718.2	4.76
*Famous Molasses & Amerco Feed & Mfg.)	49	1500	31	7317.6	4.88
G. E. Conkey & Co.	35	1218	35	5943.27	4.88
Gt. Western Bean & Produce Co.	51	1184	23	5737.37	4.85
Livingston Mill & Elevator Co.	20	349	17	1774.5	5.09
TOTAL	328	11379	35	53311.84	4.68

*One inspector handled both mills in one laboratory. Analyses are reported combined.

This table indicates the average arsenic content of the bait produced and the degree of supervision which was exercised over the mill production. Bait was rejected because of either too low or too high arsenic content. Four per cent (4%) arsenic was set as the minimum. Three hundred seventy (370) tons of bait were rejected for one or the other of these reasons.

V. Distribution of Baits

(A) Tons of bait and of raw materials in bait equivalent shipped each state:

<u>State</u>	<u>Tons Bait Shipped</u>	<u>Tons Raw Material in Bait Equivalent</u>	<u>Total Tonnage Shipped</u>
Arizona	20	370.75	370.75
California		645	645
Colorado		2,070	2,070
Idaho	705		705
Iowa	200.4	200.48	200.48
Kansas		537.5	537.5
Michigan	45	1,195	1,195
Minnesota	1,981.72	65	2,046.72
Montana	19,109.4		19,109.4
Nebraska	2,082.64		2,082.64
Nevada		311.75	311.75
New Mexico	40	569	569
North Dakota	26,996.19	1,308	28,304.19
Oregon		402.5	402.5
South Dakota	12,830.95		12,830.95
Utah	300	300	300
Wisconsin	1,850	385	2,235
Wyoming	4,320	135	4,455
Total	72,411.38	7,889.50	78,370.88
	69,875.90	8,494.98	

(B) States Using Supplementary Bait

The following tabulation is derived from information received by Mr. Gaddis from the State Leaders and represents all the data available at this time. There may have been additional purchases by some states which are not included in this tabulation:

STATES USING SUPPLEMENTAL BAIT

<u>State</u>	<u>Source of Funds</u>	<u>Amount</u>	<u>*Tons Bait</u>
Minnesota	State	\$150,000.00	6,000
Wisconsin	State & Counties	35,000.00	1,400
Wyoming	FERA (Drought Relief)		2,675
Montana	" "	"	340
Nebraska	" "	"	400
North Dakota	" "	27,366.25	1,094.6

11,909.6 Tons

*Estimated at \$25.00 per ton for Minnesota, Wisconsin, and North Dakota.
Actual for other states.

(C) Relation of Mixing Mills to Delivery Points

A map is given on Page 13 which shows the geographic distribution of bait from the mixing mill areas.

(D) Tariff Concessions

The Western Trunk Lines granted certain tariff concessions which were of very material assistance in satisfactorily distributing the materials, particularly in view of the fact that the time element was a controlling factor in the success of the campaign. These concessions made by the Western Trunk Lines and other designated railroads allowed:

1. One half of the commercial rate on inbound shipments of wheat bran, molasses, crude arsenic, and sawdust used in the manufacture of grasshopper bait.
2. One half of the commercial bran rate on outbound shipments of mixed bait. This being equivalent to much less than one half of the commercial rate on grasshopper bait.
3. Free demurrage privileges on shipments of grasshopper bait.
4. Waiver of charges for reconsignments on bait shipments.
5. Partial unloading privileges on bait shipments.
6. Preferential handling of shipments of raw materials and mixed bait.

These concessions were of inestimable value, both in the monetary saving effected, and in the expeditious handling of shipments.

(E) Reports from states on the Delivery and Quality of the Bait

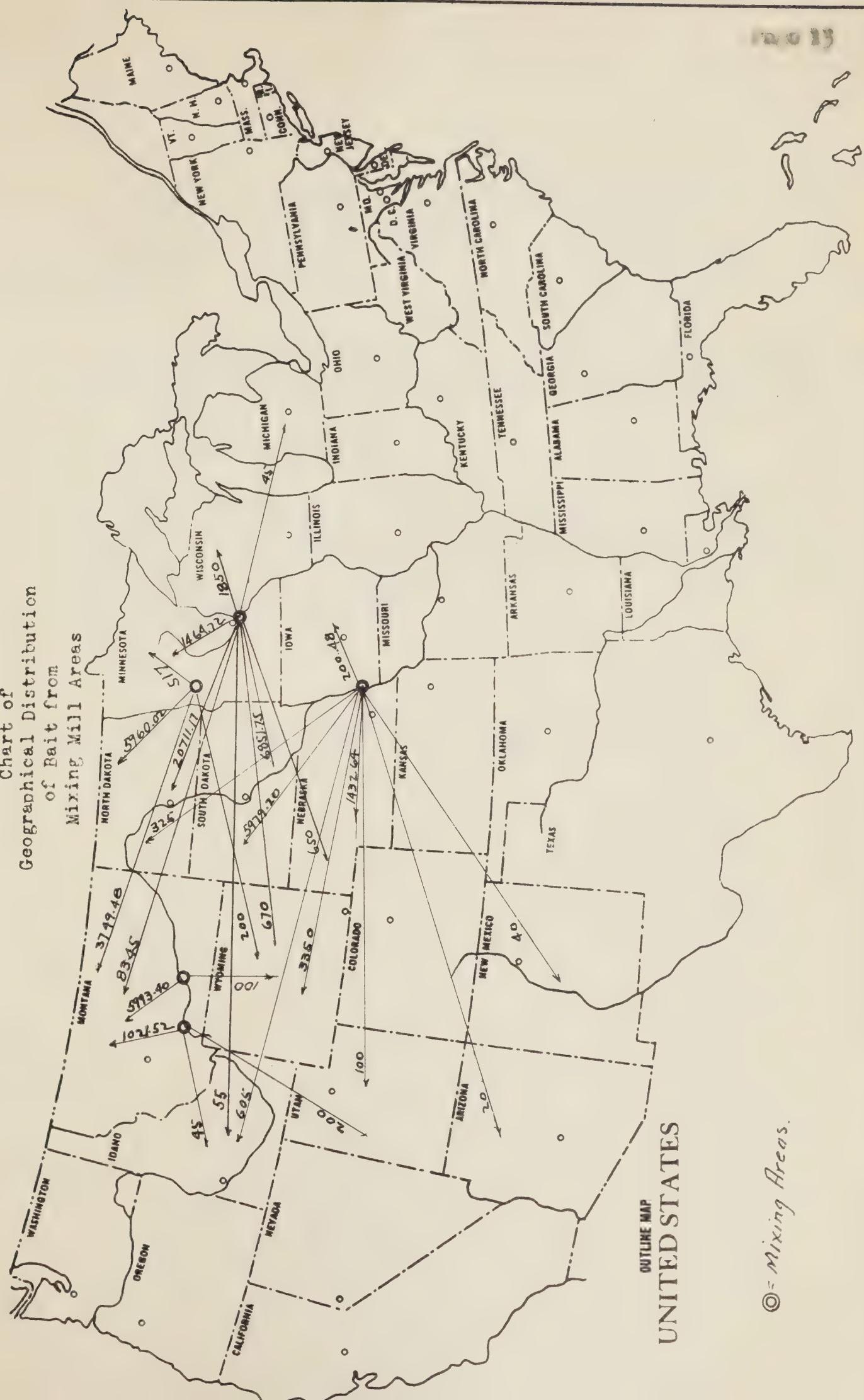
The opinions of various State Leaders expressed in preliminary reports with reference to the delivery service and the bait are reviewed below:

State	Was Delivery Service Satisfactory	Was Bait Satisfactory
North Dakota	Delivery satisfactory.	Some lumpy bait.
Montana	Excellent.	Excellent.
South Dakota	Satisfactory.	Satisfactory.
Wyoming	"	Quality poor.
Minnesota	"	Satisfactory.
Nebraska	"	"
Idaho	"	"
Colorado	"	"
Michigan*	"	"
Kansas*	"	"
Nevada*	"	"
Utah*	"	"

(See next page)

Page 13

**Chart of
Geographical Distribution
of Bait from
Mixing Mill Areas**



UNITED STATES
OUTLINE MAP

◎ = Mixing Areas.

<u>State</u>	<u>Was Delivery Service Satisfactory</u>	<u>Was Bait Satisfactory</u>
California*	Satisfactory	Satisfactory
Oregon*	"	"
Arizona	"	"

*These states did not receive mixed bait and various formulas were used. Good results were secured through the use of bran, sodium arsenite, and water without the addition of molasses or other materials.

VI. Results of the Campaign

Unfortunately it is too early for detailed reports of the various states to be available and a detailed review of the campaign results will have to be made at a later date. The tabulations given on Pages 15 and 16 review, however, data which have been obtained from the final state reports available, from preliminary state reports, and from correspondence with various State Leaders.

Much of the material utilized in this report has been taken directly from the final report of B. M. Gaddis.

August 25, 1934.

SUMMARY OF STATE REPORTS ON EFFECTIVENESS OF CAMPAIGN

<u>State</u>	<u>Crop Protection</u>	Possible Effect on Next Year's Infestation
Arizona	Very satisfactory	Reduced due to bait plus other factors
California	A success	Not stated
Colorado	Very effective	Predict marked effect
Idaho	Complete	Not stated
Kansas	Bait not adequate Otherwise perfect control	Doubtful
Michigan	Practically 100%	Not stated
Minnesota	Successful beyond expectations	Not stated
Montana	75 to 90% crop in heaviest infested area saved solely through poisoning	Heavy infestation expected 1935
Nebraska	Fully effective	Expect little difficulty in northeast section
Nevada	Very satisfactory	Heavy spotted in- festation expected
North Dakota	Good	Indicated reduction
Oregon	Very effective	Should lessen 1935 infestation
South Dakota	Effective	Not stated
Utah	Very satisfactory	Not stated
Wyoming	1 per cent damage as of July 10, 1934	Uncertain

SUMMARY OF STATE REPORTS ON ECONOMIC SPECIES
AND CASES OF POISONING OCCURRING

<u>State</u>	<u>Principal Economic Species Encountered*</u>	<u>Arsenical Poisoning of Man, Beast and Fowl</u>
Arizona	2, 1, 10, 3, 5	No report
California	2, 1, 11, 12, 3, 8, 5, 9	No serious poisoning reported
Colorado	3, 2, 8, 13, 1	No report of serious poisoning
Idaho	2, 4, 1	No report of poisoning received
Kansas	2, 4, 3	No report of poisoning received
Michigan	1, 4, 2, 8	No report of serious poisoning
Minnesota	1, 4, 2, 5, 7, 8	Less than in any other year of control work
Montana	2, 4, 1, 5	Few minor burns to man. Perhaps 100 head of cattle poisoned. Game birds not affected.
Nebraska	4, 3, 2, 8	No reports of poison to persons. Minor livestock poisoning.
Nevada	2, 1, 4	No report of poisoning received
North Dakota	1, 2, 4, 5, 7, 3, 8	Less than anticipated
Oregon	1, 8, 4, 2	No poisoning reported
South Dakota	4, 2, 3, 1, 8	No reports of injury to persons. A few cows and horses poisoned.
Utah	1, 2, 8, 5, 4, 6	No poisoning to persons or livestock. Few chickens possibly killed by arsenic.
Wyoming	4, 2, 5, 1, 8	No serious human poisoning. Livestock negligible.

- * 1. Cannula pellucida 7. Dissosteira carolina
2. Melanoplus mexicanus 8. Melanoplus femur-rubrum
3. Melanoplus differentialis 9. Dedoleonotus enigma
4. Melanoplus bivittatus 10. Schistocerca shoshone
5. Melanoplus packardii 11. Hippiscus californicus
6. Aulocara elliotti 12. Schistocerca venusta
13. Dissosteira longipennis

